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Materiel Test Procedure 3-4-007
U. S. Army Arctic Test CenterU. S. ARMY TEST AND EVALUATION COMMAND
ENVIRONMENTAL TEST PROCEDURE

ARCTIC ENVIRONMENTAL TEST OF RECOILLESS WEAPONS

1. OBJECTIVE

The objective of the procedures outlined in this MTP is to provide a means of evaluating the performance of recoilless weapons under arctic winter environmental conditions.

2. BACKGROUND

Engineering tests of recoilless weapons are conducted to determine the characteristics and performance of the weapons under various conditions of operation, and to ensure their compliance with specified requirements. Testing in a natural arctic winter environment is used to substantiate or supplement data obtained from simulated tests conducted during the Engineer Design and Engineering Test phase. Testing in the arctic winter environment generally is not authorized until data from simulated environment tests provides reasonable assurance that the test item will function satisfactorily when subjected to the conditions that would be encountered in the arctic.

3. REQUIRED EQUIPMENT

- a. Appropriate Arctic winter uniforms and individual field gear.
- b. Weapons (Comparison).
- c. Ammunition.
- d. Steel targets.
- e. Vehicles (Cargo).
- f. All general and special tools and ancillary items required to perform maintenance on the test item.
- g. Test equipment as required.
- h. Photographic equipment (black and white or color).
- i. Meteorological support facility.

4. REFERENCES

- A. AR 705-15, Operation of Materiels Under Extreme Conditions of Environment.
- B. AR 705-5, Army Research and Development.
- C. AR 70-10, Army Materiel Testing.
- D. AR 70-8, Human Factors and Social Sciences Research.
- E. USATECOM Regulation 350-6, Training in New or Modified Equipment and Training Devices.
- F. MTP 10-4-500, Arctic Preoperational Inspection, Physical Characteristics, Human Factors, Safety and Maintenance Evaluation.

5. SCOPE

5.1 SUMMARY

The procedures outlined in this MTP are designed to determine and evaluate the functioning characteristics of recoilless rifles under arctic winter environmental conditions.

The specific tests to be performed and their intended objectives are listed below:

a. Preoperational Inspection and Physical Characteristics - This subtest provides for an inspection of the test item to determine:

- 1) If the test and comparison (control) items are in proper condition for testing.
- 2) If the test item's physical characteristics conform to applicable criteria.

b. Firing Test - The objective of this subtest is to determine the accuracy of recoilless rifles under arctic winter environmental conditions.

c. Position Disclosing Effect - The objective of this subtest is to determine and measure the position disclosing effect created by the cumulative smoke, muzzle flash and ice fog of the weapon when fired under arctic winter environmental conditions.

d. Functional and Operational Suitability - Portability - The objective of this subtest is to determine the ease of carrying and transporting the test weapons cross-country and over ski trails while wearing snowshoes and skis.

e. Human Factors Engineering - The objective of this subtest is to determine if all accessories and components of the test weapons enable easy operation by test personnel wearing the appropriate arctic winter uniform.

f. Maintenance Evaluation - The objective of this subtest is to determine if the test weapon meets maintenance and reliability requirements as defined by QMR, SDR, TC, MC or other established criteria under arctic winter environmental conditions.

5.2 LIMITATIONS

The procedures described in this MTP are limited to the testing of recoilless rifles under arctic winter environmental conditions. Specific tests for other type weapon systems may be performed using this MTP as a guide with variations applicable to the weapon to be tested.

6. PROCEDURES

6.1 PREPARATION FOR TEST

a. Since arctic winter environmental tests are normally scheduled from October through March (6 month), ensure that the test items, test and comparison weapons are delivered to the Arctic Test Center prior to 1 October.

b. TDY personnel shall be used to augment assigned personnel and shall be trained to the degree that they are as proficient on the individual weapons as the troops who will use the weapon.

c. Ensure that all test personnel are familiar with the required technical and operational characteristics of the item under test, such as stipulated in Qualitative Materiel Requirements (QMR), Small Development Re-

quirements (SDR), and Technical Characteristics (TC), and record this criteria in the test plan.

d. Review all instructional material issued with the test item by the manufacturer, contractor, or government, as well as reports of previous tests conducted on the same type of equipment, and familiarize all test personnel available for reference.

e. Record the grade, MOS, background, and training of all test personnel and ensure that all personnel receive new equipment training (NET) as referenced in 4.E

f. Record the following information:

- 1) Nomenclature, serial number(s), and manufacturer's name of the test items.
- 2) Nomenclature, serial number(s), accuracy tolerances, calibration requirements, and last date calibrated of the test equipment selected for the tests.

g. Select test equipment ideally having an accuracy 10 times greater than that of the function to be measured.

h. Prepare record forms for systematic entry of data, chronology of test, and analysis in final evaluation.

i. Prepare adequate safety precautions to provide safety for personnel and equipment, and ensure that all safety SOP's are observed throughout the test. Ensure that a Safety Release has been obtained prior to test conduct.

j. Outfit all test personnel in appropriate arctic winter clothing as described in MTP 10-4-500, and with individual field equipment, during all recoilless rifle testing.

k. Ensure that when not in use, all test and comparison recoilless weapons are stored and maintained in an unsheltered area and exposed to ambient air temperature and prevailing weather conditions.

l. Record the prevailing meteorological conditions during the storage phase, as well as test conduct, to include:

- 1) Temperature
- 2) Humidity, relative or absolute
- 3) Temperature gradient
- 4) Atmospheric pressure
- 5) Precipitation
- 6) Solar radiation
- 7) Wind speed and direction
- 8) Frequency of readings
- 9) Source of data
- 10) Time in storage

6.2 TEST CONDUCT

NOTE: When conducting individual ammunition tests involving several subjects, samples and conditions i.e., range, temperature, position, etc., a "Latin Square" or comparable test design procedure will be imposed to assure a representative distri-

bution of variables and minimum biasing.

6.2.1 Preoperational Inspection and Physical Characteristics

Upon receipt, carefully inspect all test items and comparison ammunition and their shipping or packaging containers for completeness, damage and general conditions in accordance with the applicable sections of MTP 10-4-500.

6.2.2 Firing Tests

6.2.2.1 Accuracy

6.2.2.1.1 Stationary Target Firings

a. Cold-soak (outdoors for a period of at least 24 hours) all test and comparison weapons.

NOTE: Each phase of the subtest shall be conducted in ambient air temperature of 0°F to -25°F, -25°F to -45°F and -45°F to the lowest available temperature.

b. Install stationary steel plate targets (2.3 x 2.3 meters) at minimum, intermediate and maximum range of the weapon.

c. Zero the weapons at the appropriate range. Record any difficulties encountered.

d. Order two test crews to engage the target and fire in accordance with Table I.

TABLE I

Type Target	Range-to-Target	Shots	Number of Exercises Conducted	Time
Stationary	Minimum	5	2	No Limit
Stationary	Intermediate	5	2	No Limit
Stationary	Intermediate	5	2	No Limit
Stationary	Maximum Range	5	2	No Limit

e. Repeat the above steps using comparison weapons.

6.2.2.1.2 Moving Target Firings

a. Cold-soak (outdoors for a period of at least 24 hours) all test and comparison weapons.

NOTE: Each phase of the subtest shall be conducted in ambient air temperature of 0°F to -25°F -25°F to -45°F and -45°F to the lowest available temperature.

b. Emplace a target (2.3 x 2.3 meters) at the appropriate range.

c. Zero the test and comparison weapons at the appropriate ranges. Record any difficulties encountered.

d. Order two test crews to engage the target and fire in accordance with Table II.

NOTE: The target shall move at 25 KPH.

TABLE II

Type Target	Range-to-Target	Shots	Times Conducted	Time
Moving, L to R	Minimum	9	2	No Limit
Moving, R to L	Intermediate	9	2	No Limit
Moving, L to R	Maximum	9	2	No Limit

e. Repeat the above steps using comparison weapons.

f. Record the following data:

- 1) Difficulties in zeroing the weapons.
- 2) Number of rounds fired and percentage of hits at each range.
- 3) Ambient air temperature at test site.
- 4) Type ammunition fired.
- 5) Weapon malfunctions.
- 6) Mean radius, maximum vertical spread, maximum horizontal spread, total maximum spread and standard deviation.
- 7) Excessive noise.
- 8) Powder burns.
- 9) Wind velocity and relative direction in relation to gunner.

6.2.3 Position Disclosing Effect

a. Cold soak (outdoors for a period of at least 24 hours) all test and comparison weapons.

b. Each phase of this subtest shall be conducted in ambient air temperature of 0°F to -25°F, -25°F to -45°F and 45°F to the lowest available temperature.

c. Mount cameras, perpendicular to the muzzle of the test weapons at a sufficient distance to photograph the flash.

d. Position an observer behind each of five gunners and down range along one flank of the safety fan at range of 100, 300, 500, 1000, 1500 and 2000 meters.

NOTE: Conduct this portion of test under darkened conditions.

e. Order the test personnel to fire 20 rounds. Photograph the cumulative flash from each weapon.

f. Record the following:

- 1) Smoke, ice, fog and flash at firer positions.
- 2) Sound, smoke and flash effects visible to the observers at

indicated ranges.

- 3) Annotations to the photographs of cumulative flash with regard to variations to flash during the test.
- 4) Ambient air temperature at test site.
- 5) Light conditions.
- 6) Wind velocity and relative direction in relation to gunner.

g. Repeat steps (c) through (f) above, utilizing the comparison weapons.

h. Repeat steps (c) through (f) above, under daylight conditions but without photographing the cumulative flash.

6.2.4 Functional and Operational Suitability - Portability

a. Cold soak (outdoors for a period of at least 24 hours) all test and comparison weapons.

b. This test shall be conducted in ambient air temperature of 0°F to the lowest available.

c. Inspect all test and comparison weapons for loose, damaged or missing parts and place in the best possible condition.

d. Pack the test and comparison ammunition in the prescribed carrying case and transport the items over the following courses:

- 1) Snowshoe one (1) mile through dense, snow-covered brush.
- 2) Snowshoe one (1) mile over open-covered (cross-country) terrain.
- 3) Ski two (2) miles over cross-country ski trails.
- 4) 100 miles in wheeled vehicles and 100 miles in tracked vehicles over tank trails and secondary roads.

e. Thoroughly inspect each test item for loose, damaged or missing parts, and record the following:

- 1) Damage attributed to environmental effects
- 2) Problems encountered while transporting the weapons
- 3) Damage to weapons due to handling
- 4) Temperature at test site
- 5) Distance transported in each mode of movement

f. The test and comparison weapons shall be fired in accordance with the procedures outlined in paragraph 6.2.2.

6.2.5 Human Factors Evaluation and Safety

a. Conduct all Human Factors and Safety tests in accordance with the applicable sections of MTP 10-4-500.

b. Conduct these tests concurrently with the operational tests (Firing, Position Disclosure and Functional and Operational Suitability) as described in this MTP.

6.2.6 Maintenance Evaluation

a. Conduct all maintenance evaluation tests (maintenance and reliability) in accordance with applicable sections of MTP 10-4-500.

b. Conduct these tests concurrently with the operational tests (Firing, Position Disclosure and Functional and Operational Suitability) as described in this MTP.

6.3 TEST DATA

All test data to be recorded will be as specified in the individual subtests of this MTP.

6.4 DATA REDUCTION AND PRESENTATION

Processing of raw test data shall, in general, consist of organizing, marking for identification and correlation, and grouping the test data according to test title.

Specific instructions for the reduction and presentation of individual test data are outlined in the succeeding paragraphs.

6.4.1 Preoperational Inspection and Physical Characteristics

Preoperational inspection and physical characteristics data shall be reduced and presented in accordance with MTP 10-4-500.

6.4.2 Firing Tests

Compare mean radius, maximum vertical spread, maximum horizontal spread to maximum spread, standard deviation and percentage of hits to weapon specifications for possible deviations due to effects of arctic winter environmental conditions.

6.4.3 Position Disclosing Effect

Compare data obtained from the test weapons to the data obtained from the comparison weapons and also against accepted military standards.

6.4.4 Functional and Operational Suitability - Portability

The operation of the weapons under test in extreme arctic winter conditions shall be determined by comparison with previously accepted items of like nature and specifications. The damage to the weapons attributed to environmental effects of handling shall be compared with ammunition specifications contained in appropriate QMR or TC.

6.4.5 Human Factors Evaluation and Safety

Human Factors and Safety data will be reduced and presented in accordance with MTP 10-4-500.

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6.4.6 Maintenance Evaluation

Maintenance data shall be reduced and presented in accordance with
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